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FUNGI FOUND IN SEWAGE-EFFLUENTS.

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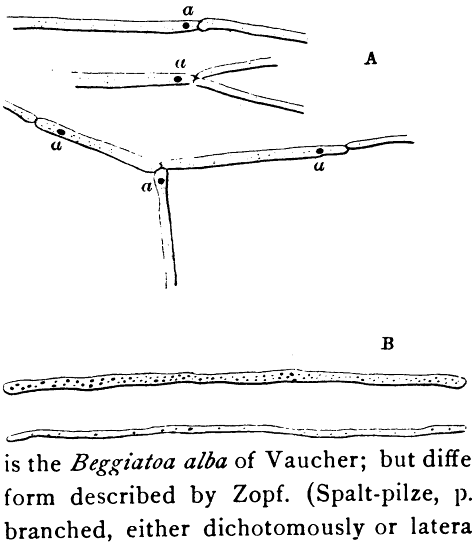
I have recently been engaged in examining the nature of the vegetable organisms found in the effluent water from works for the purification of sewage, with a view of ascertaining whether they give evidence of the purification having been inefficiently effected. Among the organisms found in these circumstances is a very remarkable one, some account of which I thought might interest the members of the American Society of Microscopists.

This organism occurs abundantly in the effluent water from sewage works, and is well known to English sanitary engineers under the name of the "sewage fungus." It forms dense, flocculent, grayish-white masses attached to the bottom and side of the channel, or to ordinary green algæ. Under the microscope it is seen to consist of an immense quantity of colorless threads, with but little or no chlorophyl, full of granular protoplasm, and containing a number of bright, strongly refractive, globular particles; it is the *Beggiatoa alba* of Vaucher; but differs slightly from the typical form described by Zopf. (Spalt-pilze, p. 76.) The filaments are branched, either dichotomously or laterally, and situated either at the base of the branches or elsewhere, and the cells are frequently



remarkably constricted, both above and below the septa. The globular refringent particles have been determined by German experimenters to consist of pure sulphur, and are most commonly situated immediately below each septum, but sometimes towards the center of a cell, or more generally diffused.

The systematic position of *Beggiatoa* is somewhat obscure. Zopf places it, without hesitation, among the lowest section of fungi, the Schizomycetes, which form one division of Sachs' primary class of Protophyta. It may, in fact, be regarded as the Leptothrix condition of an organism of this class, having also its corresponding bacillus, coccus and spirillum conditions. On the other hand, it appears to be closely allied to the Oscillatoriæ through Crenothrix.

The source of the globules of sulphur contained in this organism is a very interesting question. The *Beggiatoa* is not necessarily indicative of partially decomposed sewage; it occurs also in the effluent water from manufactories, especially from sugar factories, tanneries, etc., thermal sulphur springs, as well as in drains. Luerssen (Die Kryptogamen, p. 24), gives as its habitat putrid water, noisome ditches, the effluents of manufactories and mineral springs, especially all thermal sulphur springs, as those of the Alps and Pyrenees, Aix la Chapelle, baths at Vienna, etc. It appears, therefore, to have the power of extracting sulphur, not only from decomposing organic matter, but also from the mineral sulphates dissolved in spring water. Sulphur may be set free in this way by the mutual decomposition of soluble sulphides and sulphites. Independently of the source of sulphur in the organic matter present in the sewage itself, there is an abundant supply of this element in the substances used for purifying or precipitating the sewage, which are usually sulphate of alumina, lime and proto-phosphate of iron.

The growth of the so-called "sewage fungus" must undoubtedly, therefore, be regarded as evidence of the presence in the water of an abnormal amount of sulphates, derived either directly from sewage or from the substances used in precipitating it, or in other ways in manufactories. But there seems no reason to believe that it will itself have any injurious effects on the water. It is difficult to see how the sulphur, once set free, can again combine with hydrogen to form sulphuretted hydrogen gas, as long as the organism is growing in the water. Indeed, if allowed to accumulate and periodically removed, it may tend to purify the water by abstracting from it some of the undue proportion of sulphur.